

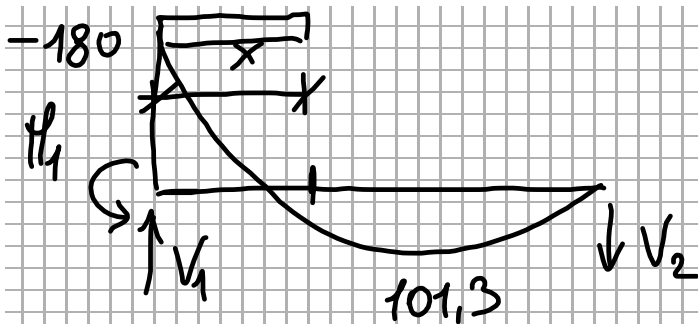
$$\frac{40 \times 6^2}{8} = \frac{q l^2}{8}$$

180 kNm

$$-180 \text{ kNm}$$

$$V_1 = 1,25 \frac{q l}{2} = 150 \text{ kN}$$

$$V_2 = -0,75 \frac{q l}{2} = -90 \text{ kN}$$

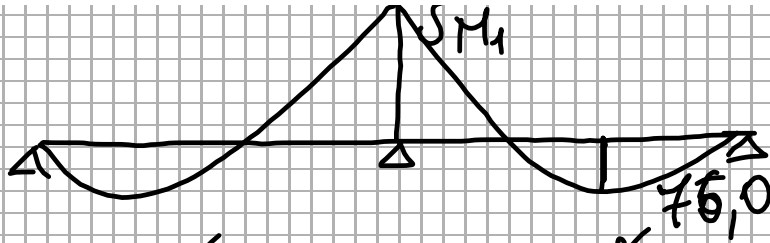


$$M(x) = M_1 + V_1 x - \frac{q x^2}{2}$$

$$\frac{dM}{dx} = V_1 - \frac{q x}{2} = 0 \Rightarrow x = \frac{V_1}{q} = \frac{150}{40} = 3,75 \text{ m}$$

$$M(3,75) = -180 + 150 \times 3,75 - \frac{40 \times 3,75^2}{2}$$

$\therefore 101,3 \text{ kNm}$



$$M_1 = \frac{q l^2}{8} = M_{Rd} = 0,75 \frac{q l^2}{8}$$

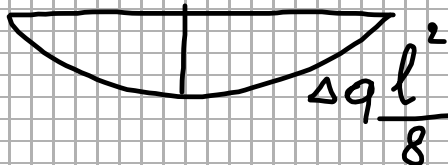
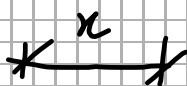
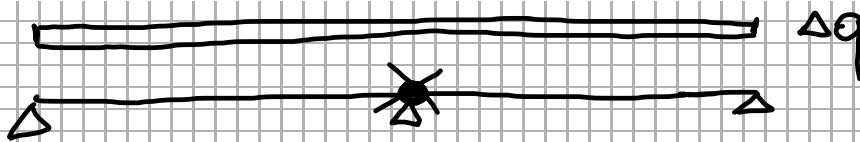
$$q_y = 0,75 q = \delta q = 30 \text{ kN/m}$$

$$M_{Rd} = \delta M_1$$

$$\delta = 0,75$$

$$M_{Rd} = 0,75 \cdot 180$$

$$= 135 \text{ kNm}$$



$$\Delta M(x) = V_1 x - \frac{\Delta q x^2}{2}$$

$$V_1^{\Delta q} = \frac{\Delta q l}{2} = \frac{10 \times 6}{2}$$

$$= 30 \text{ kN}$$

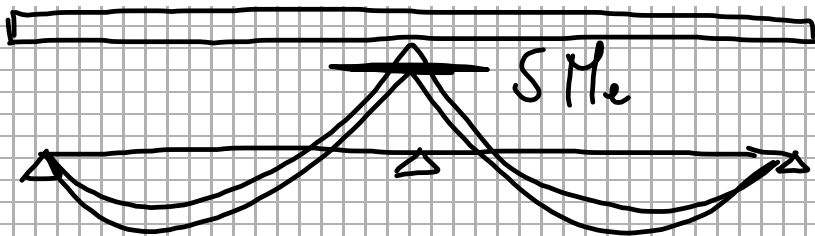
$$M(x) = M_1^{q_1} + V_1^{q_1} x - \frac{q_1 x^2}{2} + V_1^{\Delta q} x - \frac{\Delta q x^2}{2}$$

$$= M_1^{q_1} + (V_1^{q_1} + V_1^{\Delta q}) x - (q_1 + \Delta q) \frac{x^2}{2}$$

$$\frac{dM}{dx} = (V_1^{q_1} + V_1^{\Delta q}) - (q_1 + \Delta q) x = 0$$

$$x = \frac{V_1^{q_1} + V_1^{\Delta q}}{q_1 + \Delta q} = \frac{0,75 + 150 + 30}{30 + 10} = 3,56 \text{ m}$$

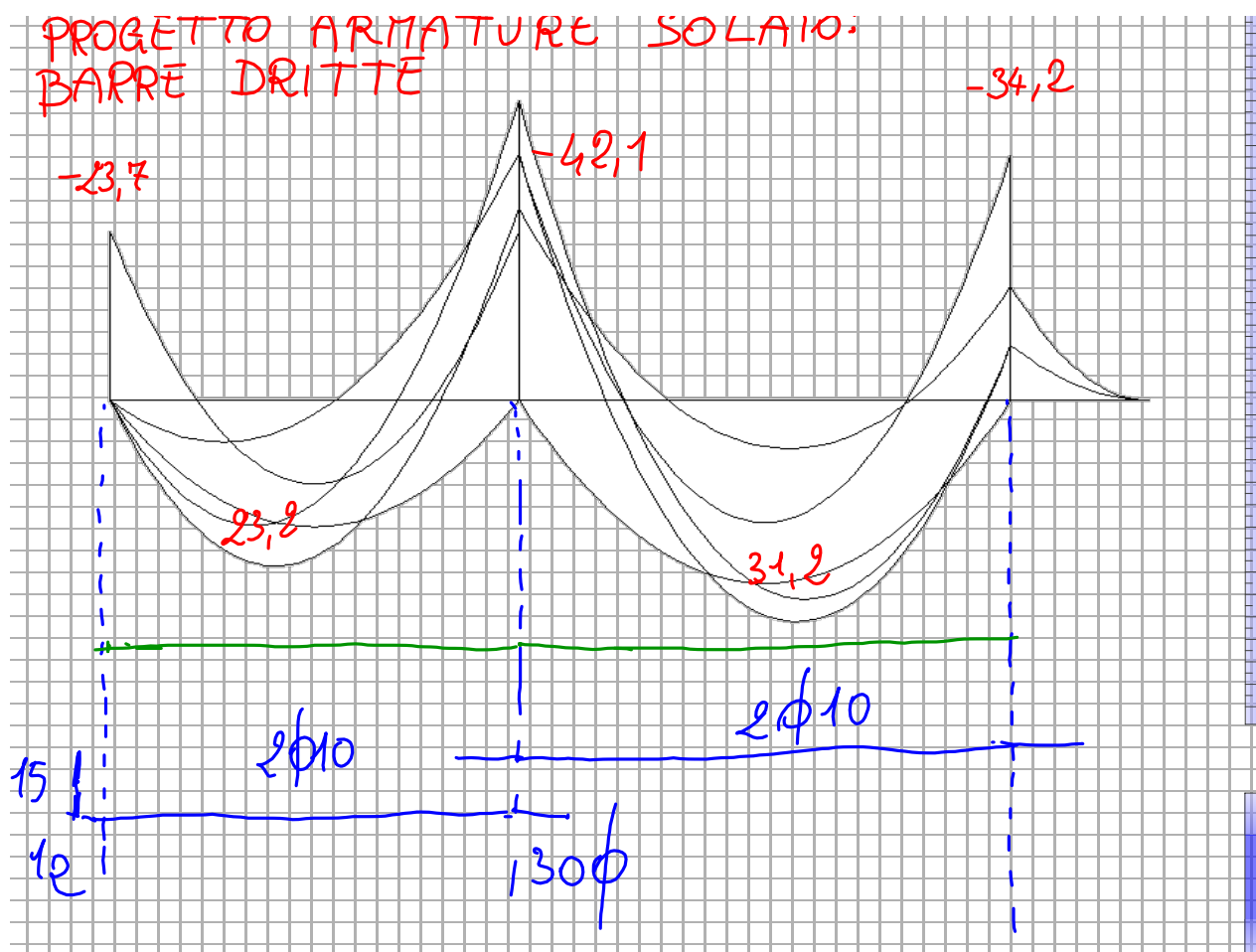
$$M(3,56) = -135 + (112,5 + 30) \times 3,56 - 40 \times \frac{3,56^2}{2} = 118,8 \text{ kNm}$$



$$S \geq 0,44 + 1,25 \left(0,6 + \frac{0,0014}{\varepsilon_{cu}} \right) \frac{x}{d} \quad f_{ek} \leq 50 \frac{MPa}{MPa}$$

$$\geq 0,44 + 1,25 \left(0,6 + \frac{0,0014}{6,0035} \right) \times 0,25 = 0,7525$$

$$\frac{x}{d} = 0,25$$



Com.	$M_{ed} (kNm)$	$d (cm)$	$A_s (cm^2)$	travetto	barre
1	23,2	22	2,99	1,0	2φ10
2	31,2	22	4,03	1,34	2φ10

$$A_s = \frac{M_{ed}}{0,9d f_{yd}} = \frac{31,2 \times 10^3}{0,9 \times 0,22 \times 391,3 \times 10^2} = 4,03$$

$$h = 25 \text{ cm}$$

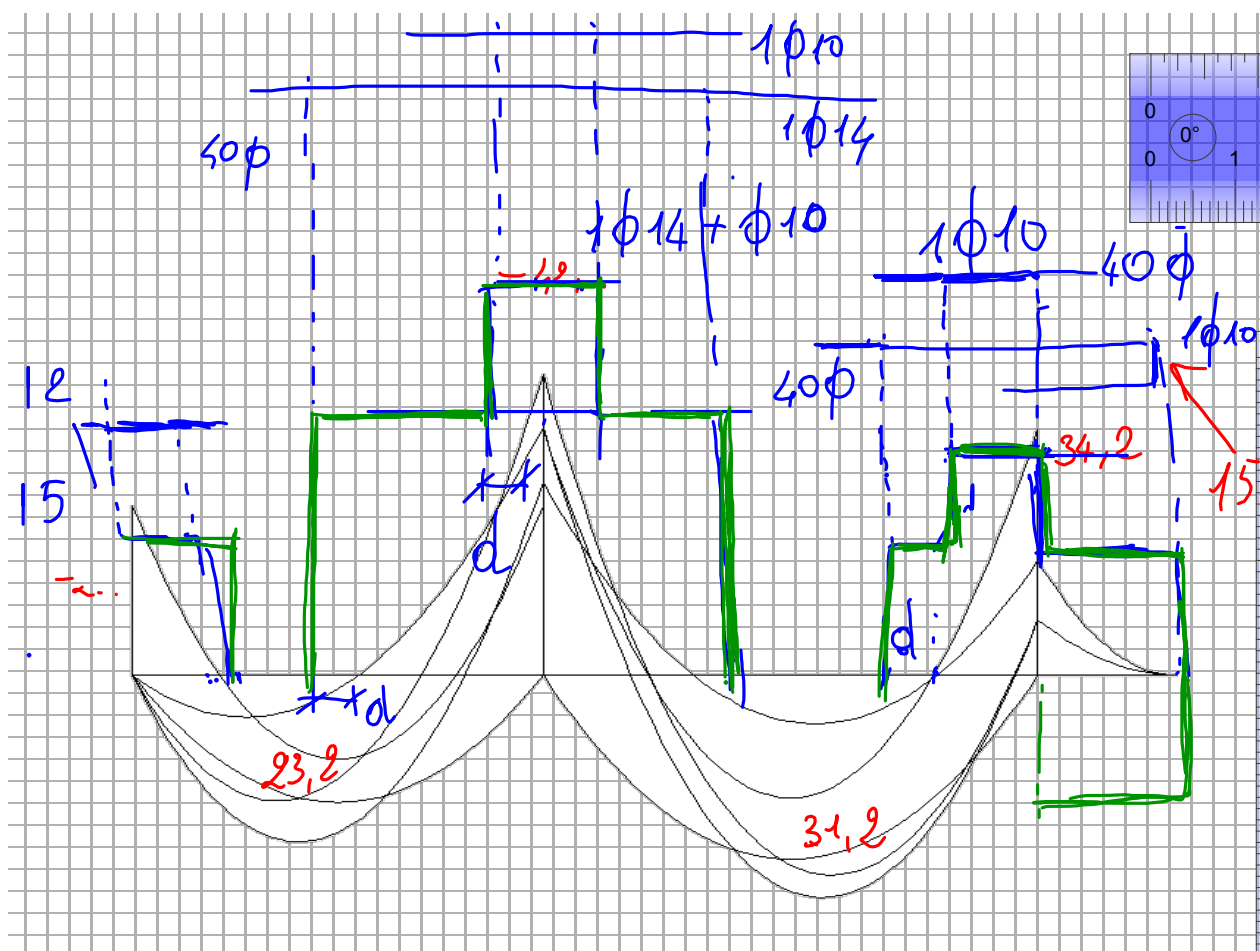
$$c = 30 \text{ mm}$$

3 travetti

$$2\phi 10 = 1,56 \text{ cm}^2$$

Com.	A_s (cm ²)	M_{Rd}
1	4,68 cm ²	36,3
2	4,68 cm ²	36,3

$$M_{Rd} = 0,9 d f_{yd} A_s = 0,9 \times 0,22 \times \frac{391,3 \times 4,68}{10} = 36,3 \text{ KNm}$$



App.	$M_{Ed} (kNm)$	$d (cm)$	$A_s (cm^2)$	ξ_{lim}	barre
1	23,7	22	3,06	1,02	1 $\phi 10$
2	42,1	22	5,43	1,81	1 $\phi 14 + 1 \phi 10$
3	34,2	18	5,4	1,80	2 $\phi 10$

$$A_s = \frac{M_{Ed}}{0,9 d f_{yd}} = \frac{34,2 \cdot 10}{0,9 \times 0,18 \times 391,3} =$$

App.	$A_s (in \text{ metro})$	d	$M_{Ed} (kNm)$
1	2,34 cm^2	22	18,1
2	6,96 cm^2	22	53,9
3	4,68 cm^2	18	29,7

$$M_{ed} = 0,9 d A_s f_{yd} = 0,9 \times 0,22 \times 2,34 \times 391,3$$

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